



ELECTRICAL LEAK LOCATION - ELL (SURVEYS & TESTING)

TOPICS

- Introduction – Conditions & Performance
- Research & Data
- ASTM's & Methods
- Projects and Results
- State Regulatory Positions
- Summary

ELECTRICAL LEAK LOCATION CONDITIONS – PERFORMANCE:

- Conductive medium above the surface.
- Conductive medium through holes.
- Conductive medium below the surface.
- Medium above surface not in contact with medium below (isolation).
- Current only flows through leaks.

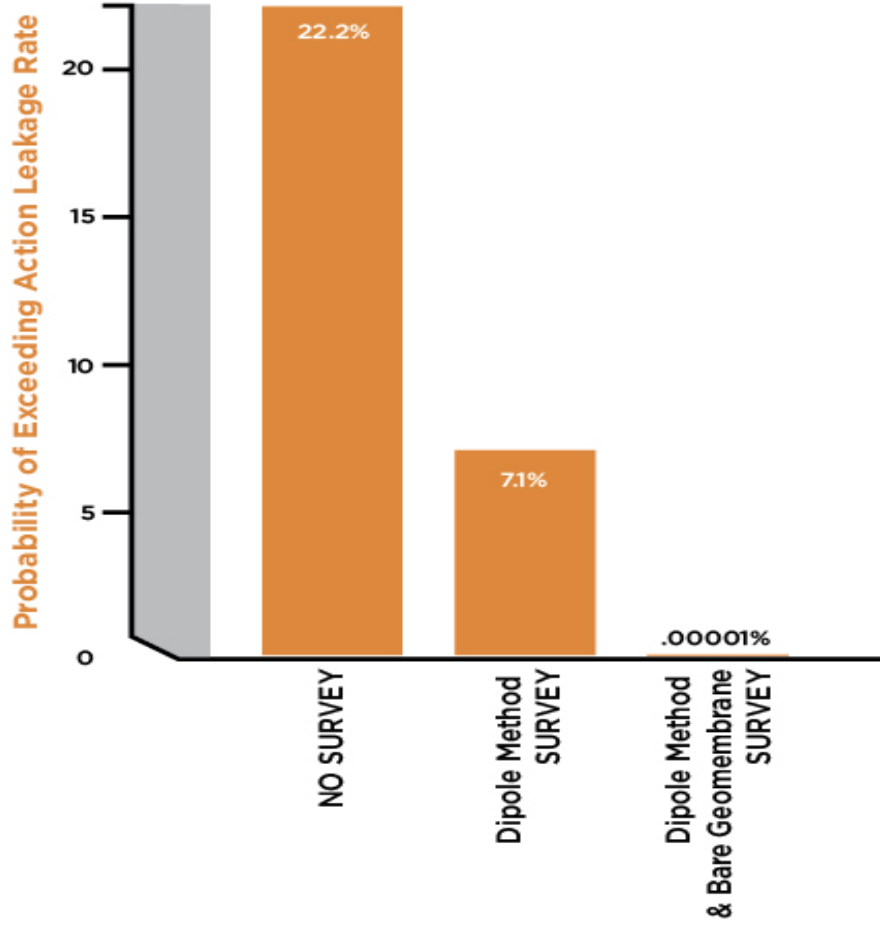
ELECTRICIAL LEAK LOCATION: ADVANCED TECHNOLOGY



RESEARCH & DATA

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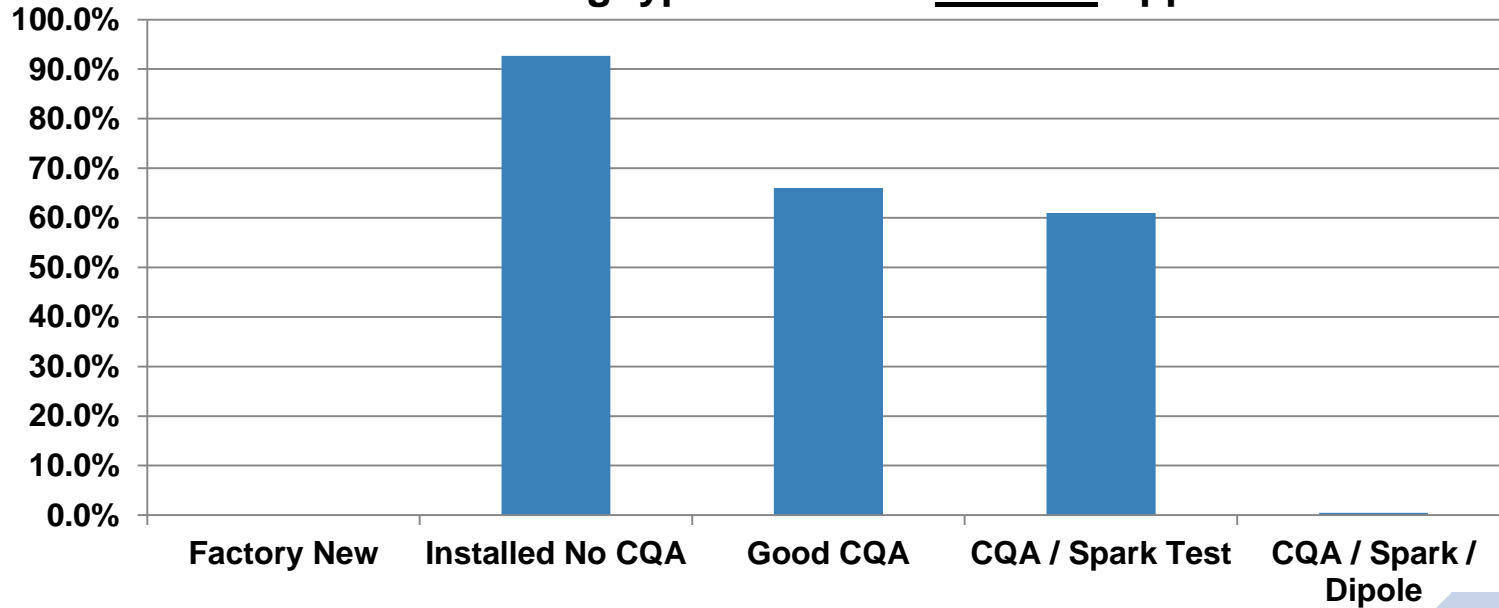
PROBABILITY OF EXCEEDING ACTION LEAKAGE RATES



According to a landfill leakage and quality assurance study (Abigail Gilson Beck, 2012), if no geoelectric survey is performed, there is a 22.2% probability of exceeding the action leakage rate (ALR), and only a 7.1% probability exists if the Dipole Method is used. However, if both an exposed geomembrane test and a Dipole survey are performed, the probability is reduced to 0.00001%.

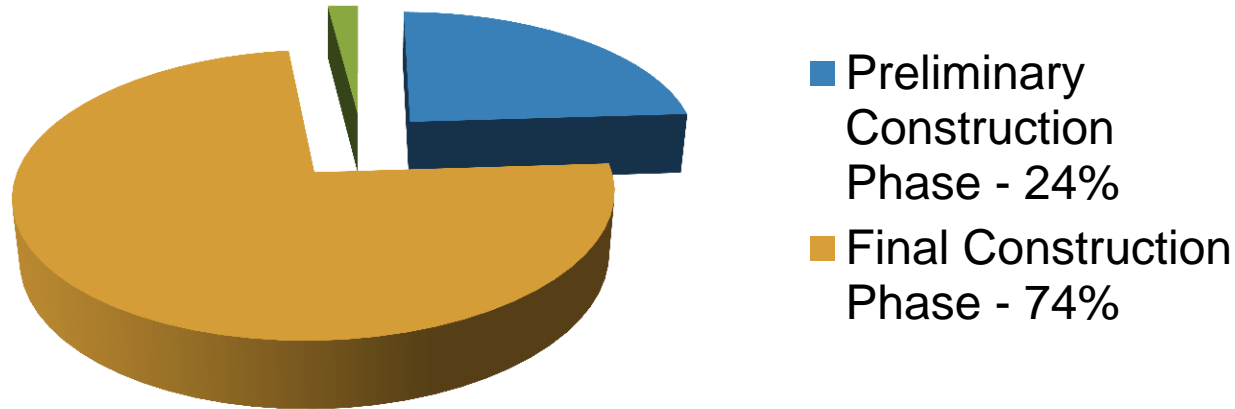
CQA & TESTING REDUCES RISK

Chance of exceeding typical ALR* in covered Applications



OCCURRANCE OF LINER DEFECTS

Survey Data - Liner Defect Occurrence, Nosko (1996)



ASTM's & METHODS

ASTM'S FOR ELECTRICAL LEAK LOCATION

- ASTM D6747 – Selection / Method
- ASTM D7002 – Exposed Water Puddle Method
- ASTM D7703 – Exposed Water Lance Method
- ASTM D7953 – Exposed Arc Testing Method
- ASTM D7240 – Spark Testing Method
- ASTM D7007 – Covered Earth / Water Method (Dipole Method)

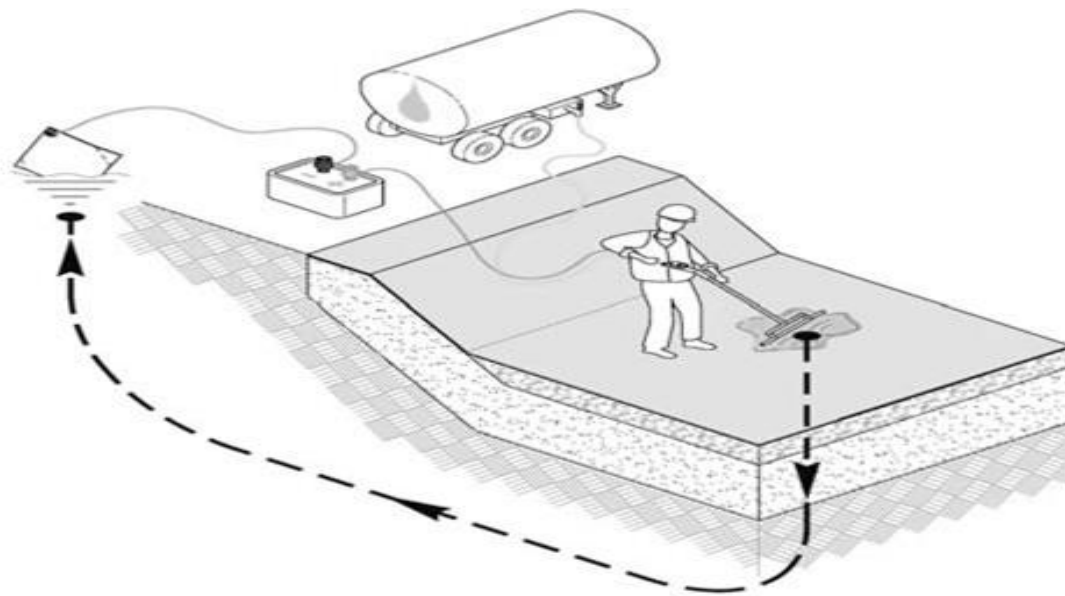
ASTM D6747

GUIDE FOR SELECTION OF THE PROPER TECHNIQUE

- Good starting point: Getting familiar with methods.
- Test Methods and Applications
- Exposed / Covered
- Comparisons & Limitations
- Each method has advantages and limitations and certain methods can be more suitable for certain conditions; the leak location practitioner should be allowed to select from available methods.

DEMONSTRATION OF EXPOSED METHOD CONCEPTS:

SET UP AND TESTING



ASTM D7002

EXPOSED WATER PUDDLE METHOD

- Can detect leaks as small as 1 millimeter diameter.
- Constant water source required.
- Installation or manufacturing defects not construction damage.
- Most suited for flat surfaces and slopes no steeper than 2H:1V.



ASTM D7703

EXPOSED WATER LANCE METHOD

- Can detect leaks as small as 1 millimeter diameter.
- Constant water source required.
- Installation or manufacturing defects not construction damage.
- Most often used on slopes but can be used on flat surfaces.

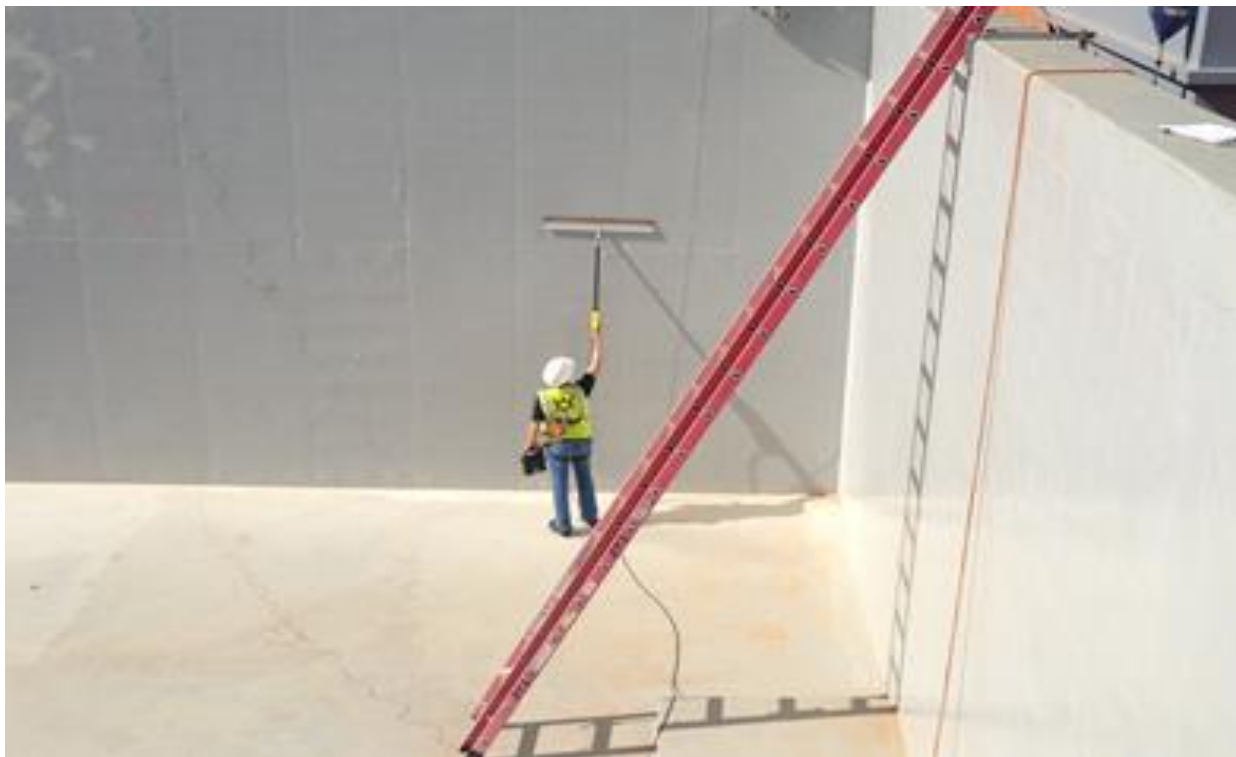


ASTM D7953

EXPOSED ARC TESTING METHOD (HOLIDAY TESTING)

- Sensitivity testing procedures same as other exposed survey methods (holes as small as 1 millimeter diameter can be detected).
- Biggest advantage: does not require application of water.
- Biggest disadvantages: no ponded water and the geomembrane has to be relatively clean.





CONDUCTIVE GEOMEMBRANES

SPARK TESTING

- For double-lined installations, electrical liner integrity surveys can't always be used, or are not as economical as spark testing.
- Only for new construction – must specify conductive-backed geomembrane.
- Works only on bare, conductive-backed geomembrane.
- Exposed seams can present issues with ELL.

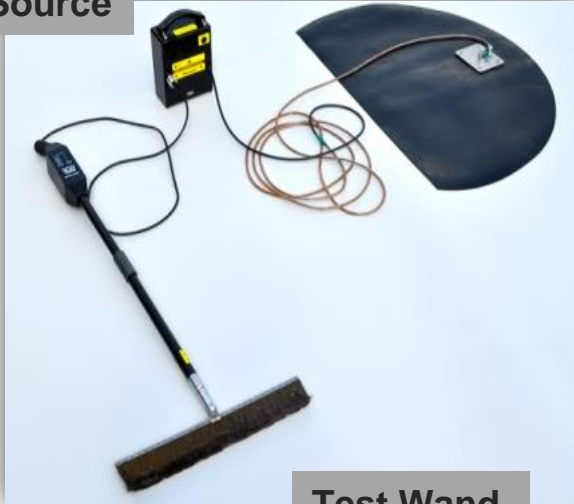
SPARK TESTING – ASTM D 7240



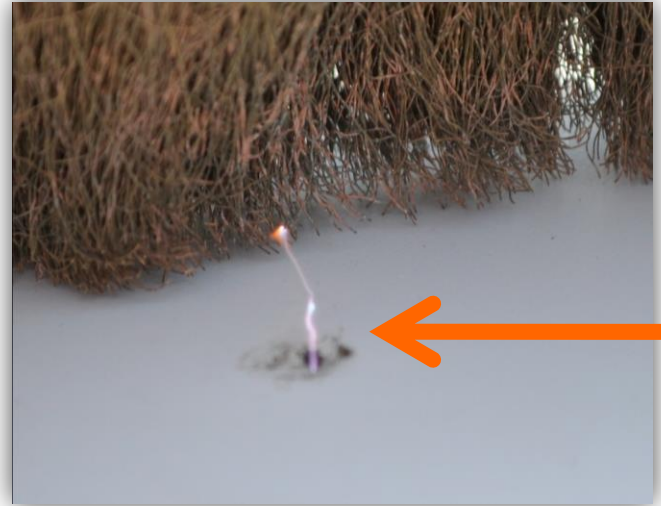
SPARK TESTING – ASTM D 7240

Power
Source

Grounding Pad



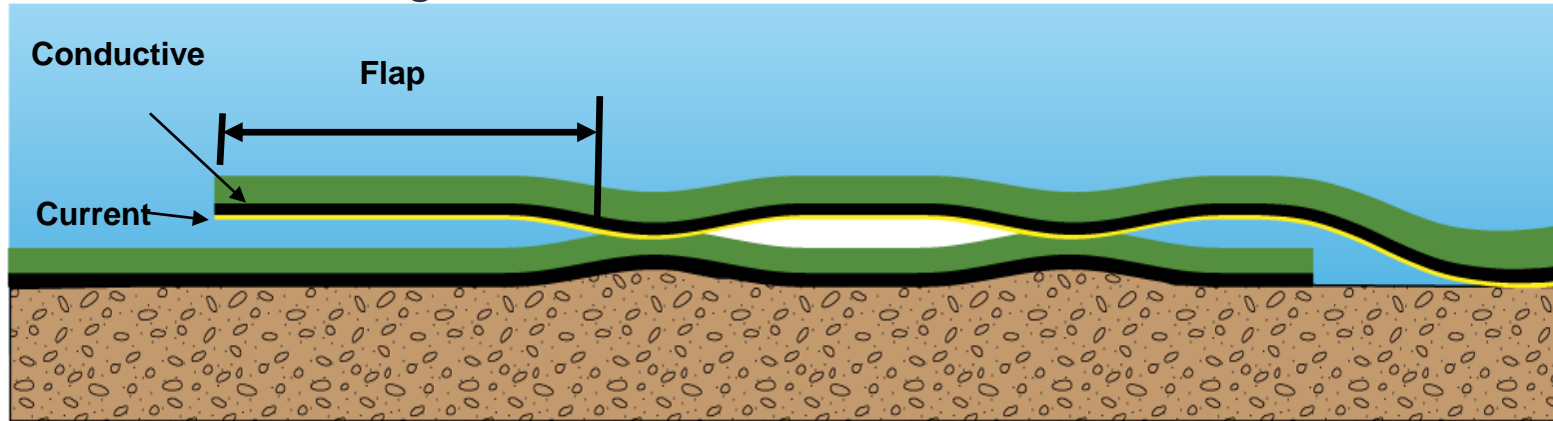
Test Wand



SPARK TESTING NEAR FUSION WELDS

CONDUCTIVE GEOMEMBRANE HAS FALSE POSITIVES

- Created when electrical current passes through the weld
- Alerts as though a leak was found



EXPOSED ELECTRICAL LEAK LOCATION (ELL) SURVEY COMPARISON

Test Method	Performed By	Water Required	Favorable Subgrade Required	Inspection During Construction
ASTM D7240 (Spark Testing)	Installer Contractor Third Party	No	No	Yes
ASTM D7703 (Water Lance)	Third Party	Yes	Yes	Only If water can be contained
ASTM D7002 (Water Puddle)	Third Party	Yes	Yes	Only If water can be contained
ASTM D7953 (Arc Testing)	Installer Contractor Third Party	No	No	Yes

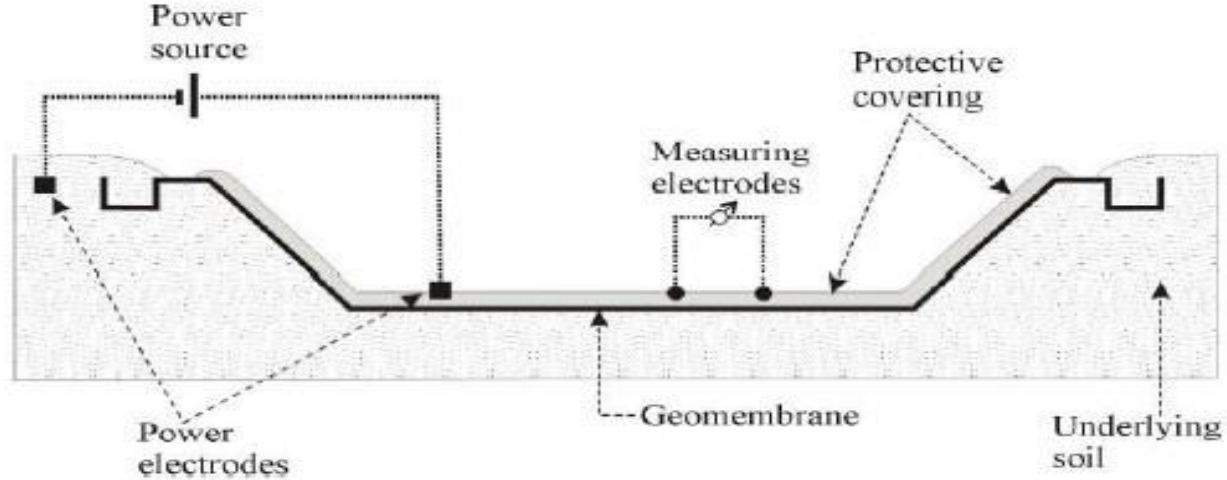
ASTM D7007

DIPOLE METHOD (COVERED)

- Performed after the cover materials are placed (water or soil/aggregate).
- Primarily used to detect large holes due to construction damage.
- Can detect holes as small as ¼-inch diameter.

DEMONSTRATION OF DIPOLE METHOD CONCEPTS:

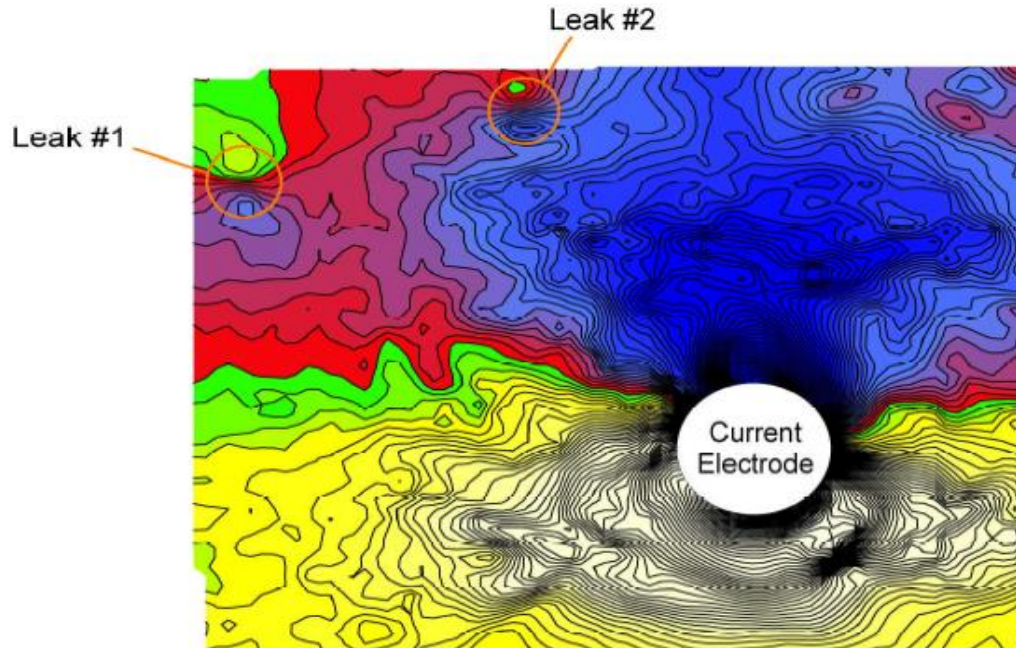
TESTING





ELECTRICAL LEAK LOCATION SURVEY RESULT – CONTOUR MAPPING

(ASTM D7007 – DIPOLE METHOD)



DAMAGE FOUND WITH DIPOLE TEST



Figure 6
Dozer Rip

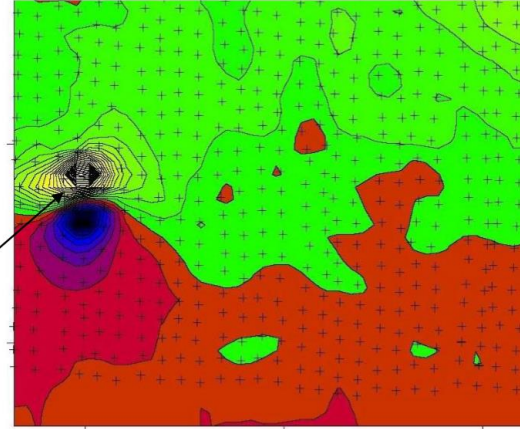


Figure 7. Corresponding Anomaly in Voltage Map at Figure 6 Leak Location

PROJECTS & RESULTS

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DIPOLE METHOD

12-INCH AGGREGATE COVER ON HDPE GEOMEMBRANE (TEAR / RIP)



DIPOLE METHOD

12-INCH AGGREGATE COVER ON HDPE GEOMEMBRANE (TEAR / RIP)



DIPOLE METHOD

12-INCH AGGREGATE COVER ON HDPE GEOMEMBRANE (PUNCTURE)



ARC TESTING METHOD

EXPOSED HDPE GEOMEMBRANE (PUNCTURE)



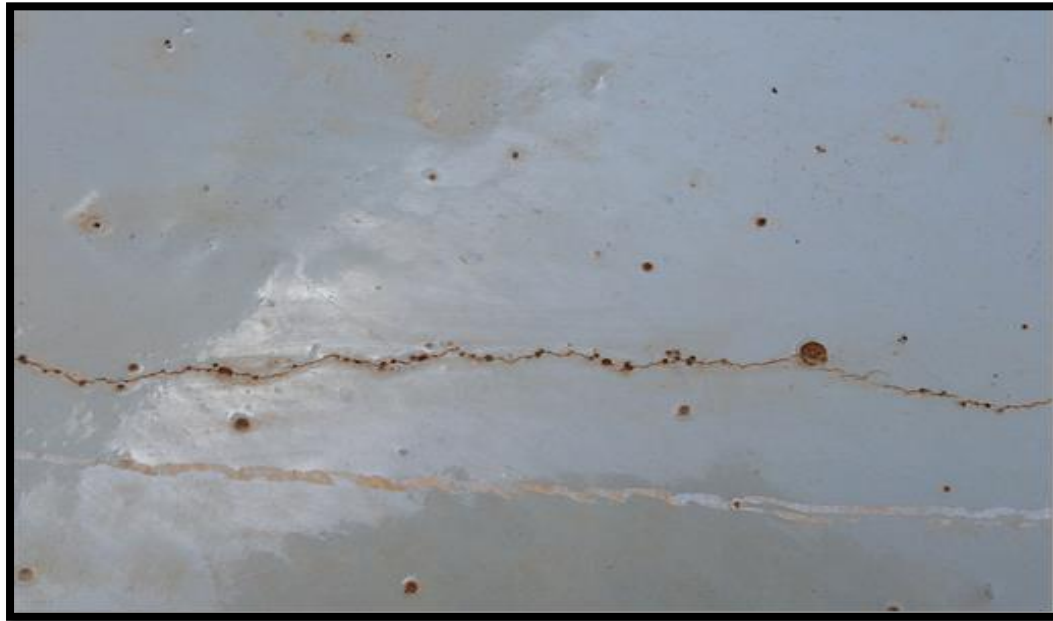
ARC TESTING METHOD

EXPOSED HDPE GEOMEMBRANE (PUNCTURE)



ARC TESTING METHOD

**EXPOSED CONCRETE BASIN WITH PAINT COATING
(CRACKS IN CONCRETE FLOOR SLAB)**



ARC TESTING METHOD

**EXPOSED CONCRETE BASIN WITH PAINT COATING
(METAL PENETRATION IN CONCRETE FLOOR SLAB)**



CONSIDERATIONS

- **Location:** South Carolina
- **Product:** 60 Mil HDPE
- **Special Conditions:** Project required to perform Electrical Leak Location under a Consent Agreement.
- **Result:** Multiple punctures found and repaired. Project engineer now requires Electrical Leak Location on all projects.

- **Location:** North Carolina
- **Product:** 60 Mil HDPE
- **Special Conditions:** NCDEQ Allowed for a reduction in cover soil placement from 2' to 1' provided an Electrical Leak Location Survey is Performed.
- **Result:** Five punctures were located and repaired following survey.

STATE REGULATORY POSITIONS

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2016 SURVEY BY THE GEOSYNTHETIC INSTITUTE

Table 3 - Results of 2016 Survey of State Environmental Agencies with Regard to Use of the Electrical Leak Location Survey (ELLS) Method

	Is Your agency familiar with ELLS?			What is your position on its use in a GM lined landfill facility?			Where in the cross section is your agency's focus?			Which stage of construction is ELLS to be performed?			What is your agency's position on ELLS for locating leaks in surface impoundments?		
	YES	Somewhat	NO	Regs Require	Site Specific	None	Primary FML	Secondary FML	Final Cover	After GM Installation	After Soil Cover	After Operations begin	Regs Require	Site Specific	None
AZ		X				X									X
CA		X			X		X			X	X			X	
CT			X			X									X
FL	X				X		X	X			X			X	
GA			X			X									X
HI			X			X									X
ID	X					X				X					X
IL		X			X					X					X
IO	X					X	X			X					X
KY	X					X	X			X					X
LA		X			X		X		X	X				X	
MD		X				X									X
ME	X				X		X				X			X	
MI	X					X	X			X					X
MO	X				X		X				X				X
MT	X				X		X				X			X	
NJ	X			X			X			X					X
NY	X			X			X	X			X			X	
NC	X			X			X				X				X
OH	X				X		X				X				
PA	X					X									X
RI		X				X		X				X			X
SD		X				X									X
TN		X				X	X	X	X		X				X
TX		X				X									X
UT	X					X	X					X			X
VA	X				X									X	
WI	X			X			X				X				X
WY	X				X		X				X			X	
Total	17	9	3	4	10	15	17	4	2	8	11	2	0	8	20
		29			29			23			21			28	

CHECKLIST

- Responsibilities – All parties involved / acknowledgments.
- Laborers – Assistance needed during the survey.
- Equipment – Machines and operators if necessary.
- Isolation & Conductivity – Maximize results.
- Power Supply
- Safety

SUMMARY

- Provisions for Electrical Leak Location should be addressed as part of the construction contract.
- More and more states including North Carolina are requiring ELL surveys on all New Landfills, or on a site by site basis depending on need.
- Electrical Leak Location Contractor needs to review plans and specs carefully and communicate with the General Contractor early in the project.
- Beware of using marketing material as your specifications.
- Never specify a maximum allowable or minimum detectable hole size (use ASTM for guidance and direction).
- Do not specify a certain method be used. Rather, specify that ASTM D6747 be used to make the selection.



QUESTIONS?



Andrew Colby
Engineering Associate
Bunnell-Lammons Engineering, Inc,
Mobile Phone Number: 864.380.8545
Office Phone Number: 864.288.1265
andrew.colby@blecorp.com